MIXED MARINE, BRACKISH WATER AND NON-MARINE MICROFAUNAL ASSOCIATION IN THE INTER-TRAPPEAN BEDS (EARLY PALAEOCENE) OF JHILMILI, CHHINDWARA DISTRICT, MADHYA PRADESH by S.C. Khosla, M.L. Nagori, S.R. Jakhar and A.S. Rathore. Jour. Geol. Soc. India, v.73, 2009, pp.724-732.

The diagnostic planktic foraminifera *P. pseudobulloides* reported by Khosla et al. in Jhilmili intertrappeans (JIT), Chhindwara (M.P.), indicating a KTB in Central India, is a significant discovery. However contrary to the authorsô view, marine incursion from west coast through (active) Narmada rift-lineament in Early Paleocene is more plausible than from east coast through Godavari lineament, as given below.

Besides brackish water ostracods (*Neocyprideis, Buntonia*), many foraminifers (Globorotaliidae, Heterohelicidae) reported from Jhilmili (Keller et al. 2009 & references therein) had existed variously in west coast (Sastri, 1988) since Late Cretaceous; similar smaller foraminifera (with some variations) occur in well-studied marine KTB in Um Sohryngkew River, Meghalaya (Pande, 1978). *Turborotalia* (including subgenus *Subbotina*) *pseudobulloides–T. inconstans–T. praecursoria* (=*Globigerina uncinata*) assemblages, abundant *Hedbergella bornholmensis* (vis-à-vis authorsô *H.* sp. cf. *holmdelensis*), *Heterohelix* spp., *Neocyprideis vandenboldi*, *Neocytherideis, Paracypris, Buntonia/ Protobuntonia*, *Miocyprideis* and other cytheracea (with Madagascarian/ African affinities) and non-marine cypridacea ostracods had been reported from: subsurface occurrences (of Cambay Basin; Jura Dome, Kutch; Jaisalmer, Rajasthan); Badia and Pipaldehla (~8 km E of Jhabua) of Bagh Group (Sastri, 1988; Keller et al. 2008*, Nayak, 2004 & references in them), which are minor variants vis-à-vis those of authorsô

Reported pre-/ syn-Deccan intermittent marine conditions, namely: a) remains of coastal flora and variously occurring *Igdabatis* and *Lepisosteus* (fishes) in intertrappeans of Mandsaur-Khandwa-Kisalpuri (Dindori) tract, b) abundant phytoplanktons *Deflandrea*, *Dinogymnium*, *Gonyaulacysta*, *Palmidites*, *Proxapertites* in Lameta type area (Jabalpur), c) mangrove, coastal, arborescent palynoforms in Mohgaon Kalan, could be ascribed to following reasons.

The Narmada rift-lineament (including Tapti Fault in Central Indian Tectonic Zone, CITZ) is a 1300 km linear zone of deep crustal faults, magmatic underplating (Acharyya and Roy, 2000), domal uplift, N-S crustal extension, intra-plate rifting, and basalt eruption through ENE-WSW primary feeder dykes and sills (cf. Bhattacharji et al. 1996, Sen and Cohen, 1994), as evident from: tholeiites/MORBs, xenoliths of Bagh/Lameta sediments in flows, pillow lavas in Mandla-Kundam area emplaced from nearby craterlets, high heat flow and gravity, magnetotelluric and geochemical data. This fundamental, ancient fault zone has been episodically active from Paleoproterozoic onwards with resurgent tectonism (e.g. Quaternary vertical movement, intraplate seismicity, Khandwa Lineament). Thus many ENE-WSW trending linear straits, formed by differential subsidence of basement floor during Deccan eruption, created dynamic accommodation space for sediments. Being open to west, active and nearer to concurrent sub-aquous lava extrusions/intrusions and feeder dykes (e.g. 66.1±0.5, 65.5 ±0.6 Ma flow/dyke in Narmada, 62.5 Ma Manpur-Bagh basalts, Nisarpur dykes, pillow lavas at Bhimdongri, Chhindwara, Singori, Chargaon, Anjaniya; Solanki and Tiwari, 2005), they would be easily affected by Late Cretaceous rapid and frequent marine incursions (Badve and Ghare, 1977*) from Cambay/triple junction side. Thus, an advancing sea from west involving much shorter distance (~450 km) from the earlier existent Bagh-Pipaldehla area to Jhilmili and beyond (upto Jabalpur/ Kisalpuri), due to gradually rising altitudes of lowest basalts from west (e.g. Buldana=410 m, Chikaldara=465 m, Nagpur-Chhindwara=540 m), appears more credible in view of altitudes of JIT(=580 m) and Rajahmundry intertrappeans (RIT=250 m).

In contrast, the relatively inactive Godavari lineament in Asifabad-Rajahmundry stretch is without: a) *sensu stricto* riftogenic basalt outcrops (except domed basement, Mishra et al. 1989), b) pillow lavas, c) Tertiary sedimentation. Moreover, against the Deccan basalts flowing east from Kolhapur (eruptive source) and reaching Rajahmundry area through ancient Krishna or Godavari river-canyons (cf. Self et al. 2008 and references therein), any northwesterly marine incursion for relatively longer (800 km) distance (via Rajahmundry-Asifabad-Daiwal-Takli-Pench course by negotiating Mailaram and Chinnur basement highs enroute) to deposit planktic foraminifera by storms, high tides (cf. Keller et al. 2009) may be unrealistic due to: a) no previous (Cretaceous) undisputedly marine sedimentation in Godavari lineament and impracticality of hypothetical Jurassic seaway upto Kota, b) terminal Cretaceous greenhouse eustatic sea-levels (straddling KTB) showing gradual low-amplitude short-term rises causing less extensive flooding of lands vis-à-vis abrupt and steep falls (e.g. 50 km sea-regression and 80 m fall), c) primarily terrestrial setting of emplacement for lower traps (P0/P1a) during low sea-levels and prior to emplacement of upper trap (P1a/P1b) in Rajahmundry correlating with global regressions (cf. Keller et al. 2008* and references therein).

Further data integration showed: a) probable correlation of upper Pipardahi and lower Dhuma(å Shahpura Fm.) flows in Jhilmili respectively with the neighboring 65.5±0.3 Ma Chakhla-Delakhari Sill (å Desur Fm. of WDVP) at 900-975 m altitude (Srivastava and Ahmad, 2005) with (?)N-polarity (besides nearby younger 63.3 Ma Pachmari dykes) and lower (?)R-polarity 60-68 Ma Linga basalts (at 600 m altitude), b) magnetic susceptibility/polarity of intertrappeans of Jhiraghat, Lametaghat, Buti Bori, Takli, Kholdoda, Daiwal, Asifabad indicating C29R, whereas Dongargaon showing C30N, c) the lower (65.0±1.1 Ma) and upper (64.5±0.3 Ma) traps of Rajahmundry as well as of Jhilmili indicating respectively C29R and C29R-C29N transition (65.030-64.750 Ma), when considered from: Deccan main eruption=65.4 to 65.1 Ma, Takli (Nagpur) flow-I=63.6±0.2 Ma ages, FAD of *P. pseudobulloides* 100-150 ky after KTB (65.580 Ma) indicating ~230-730 ky depositional time in overall transgressive scenario, the 330 m (i.e. altitudinal difference between JIT and RIT), 5-10 cm/ky sea-level rise, and 25 m fall and 5 km regression in 85-65 Ma and 125 m and 26 km regression in 65-45 Ma Phanerozoic durations following Pitman, 1978 (in Hallam, 1981, p.143), negate the authorsô views but are compatible with marine incursion from west. Also, the doming caused by local eruptive source (cf. ash layers at Kaldeota, Rajahmundry, Hansen et al. 2005) would only cause sea-level falls locally.

The occurrence of: a) lacustrine condtions in Nand-Dongargaon, b) fishes (*Clupeids*, *Lepidotes*), non-marine dinoflagellates (*Palaeoperidinium*, *Selenopemphix*), diatoms (*Aulacoseira*) and freshwater algae *Pediastrum* in Daiwal River section and Anandvan, c) predominance of freshwater palynoforms, mangrove palms, diatoms besides few dinoflagellate cysts and rarity of *Igdabatis* (marine fish adapted to freshwater) in Naskal etc. do not conclusively establish Trans-Deccan (marine) Strait through Godavari lineament; whereas: a) occurrence of *G. uncinata-G. pusilla* assemblage in Jaisalmer (Sastri, 1988), b) intermixing of African, Tethyan, fauna c) endemic ostracods in intertrappeans from Mamoni to Yanagundi (Whatley and Bajpai, 2005*) and Anjar to Kisalpuri, d) *Igdabatis indicus* and *Lepisosteus indicus* and vertebrate fauna etc. variously reported around Lotkheri (Mandsaur), Bagh area, Jabalpur, Mohgaon Kalan and Nand-Dongargaon, though similarly speculative, may indicate incursion as well of Tethyan sea from northwest via these localities and need further work.

All these constraints will help to correlate Indian KTB occurrences and enrich Deccan trap geology.

References

ACHARYYA, S.K. and ROY, A. (2000) Tectonothermal History of the Central Indian Tectonic Zone and reactivation of major faults/ shear zones. Jour. Geol. Soc. India, v.55, pp.239ï 256.

BHATTACHARJI, S., CHATTERJEE, N., and WAMPLER, J.M. (1996) Timing of Narmada-Tapti Rift reactivation and Deccan Volcanism: Geochronological and geochemical evidence. Deccan Basalts, (Ed. S.S. Deshmukh and K.K.K. Nair), Gondwana Geol. Magz., Spl. v.2, pp.329ï 340.

HANSEN, H.J., MOHABEY, D.M., LOJEN, S., TOFT, P. and SARKAR, A. (2005) Orbital cycles and stable Carbon isotopes of sediments associated with Deccan Volcanic Suite, India: Implications for the stratigraphic correlation and Cretaceous/Tertiary Boundary. Gondwana Geol. Magz., Spl. v.8, pp.5ï 28.

KELLER, G., ADATTE, T., BAJPAI, S., MOHABEY, D.M., WIDDOWSON, M., KHOSLA, A., SHARMA, R., KHOSLA, S.C., GERTSCH, B., FLEITMANN, D. and SAHNI, A. (2009) Kï T transition in Deccan Traps of central India marks major marine seaway across India. Earth Planet. Sci. Lett., v.282, pp.10ï 23.

MISHRA, D.C., GUPTA, S.B. and VENKATARAYUDU, M. (1989) Godavari rift and its extension towards the east coast of India. Earth Planet. Sci. Lett. v.94, pp.344ï 352.

NAYAK, K.K. (2004) Ostracods from Nimar Sandstone, Bagh Group, Pipaldehla, Jhabua District, Madhya Pradesh, India. Gondwana Geol. Magz., v.19, pp.85ï 91.

PANDEY, J. (1981) Paleocene smaller foraminifera of Um Sohryngkew River, Meghalaya. *In:* Proc. VII Colloq. Indian Micropaleont. Stratigr. (Ed. D.A. Rasheed), Madras (1978), pp.70ï 152.

SAMANT, B. and MOHABEY, D.M. (2003) Late Cretaceous (Maastrichtian) non-marine dinoflagellate (Peridinales) and *Aquilapollenites* bearing palynoassemblage from a new Deccan inter-trap near Daiwal River section, Chandrapur District, Maharashtra. Gondwana Geol. Magz., v.18, pp.19ï 26.

SASTRI, V.V. (1988) Oil and Natural Gas Commissionôs contributions to the biostratigraphy of India since 1958. Geol. Surv. India, Spec. Pub., No.11, v.II, pp.401ï 453.

SELF, S., JAY, A.E., WIDDOWSON, M. and KESZTHELYI, L.P. (2008) Correlation of the Deccan and Rajahmundry Trap lavas: are these the longest and largest lava flows on Eartn? Jour. Volcano. Geotherm. Res., v.172, pp.3-19.

SEN, G. and COHEN, TOBI H. (1994) Deccan intrusion, crustal extension, doming and the size of the Deccan-Reunion Plume Head. *In:* Volcanism Radhakrishna Volume (Ed. K.V. Subba Rao), pp.201ï 216.

SHRIVASTATA, J.P. and AHMAD, M. (2005) A review of research on Late Cretaceous volcano-sedimentary sequences of the Mandla Lobe: implications for Deccan volcanism and the Cretaceous/Palaeogene boundary. Cret. Res., v.26, pp.145ï 156.

SOLANKI, J.N. and TIWARI, M. (2005) Significance of intertrappeans in stratigraphy of Deccan volcanic sedimentary sequence of Chhindwara, Jabalpur and Mandla area, Eastern Deccan Province, India. Gondwana Geol. Magz., Spl. v.8, pp.83ï 91.

Note: Asterisk-marked references in the text can be found in the original paper (Khosla et al. 2009, Jour. GSI, v.73, pp.724-732).